VOL. 35

COMMONWEALTH INST.
ENTOMOLOGY LIBRARY
10 JUN 1960
SERIAL
SEPARATE
As.6

an.-March
1960

No. 1

The Mysore Agricultural Journal

Published by the Mysore Farmers' Forum
Cenotaph Road, Bangalore-2

Cover: Improved Variety of Giza Cotton

[*Photo by P. R. R. Pillai*]

The
Mysore Agricultural Journal

The Journal of the Mysore Farmers' Forum

Vol. XXXV *January to March 1960* *No. 1*

President:

N. RACHIAH, B.A., B.L.,
Minister for Agriculture.

Chairman:

M. MALLARAJ URS, B.Sc., B.Sc. (EDIN.),
Director of Agriculture and Commissioner for Food Production.

Vice-Presidents:

T. R. NESVI, M.P. V. MASIYAPPA.
L. T. KARLE. KANTHA RAO DESAI.

Secretaries:

R. NARASIMHIAH. A. SESHADRI IYER.

Treasurer :

C. M. REVANNA

Editor:

DR. H. R. ARAKERI.

Assistant Editors:

D. V. MURTHY. B. K. RAMA RAO.

(The Mysore Agricultural Journal does not accept responsibility for facts or opinions expressed by contributors.)

CONTENTS

PAGE

EDITORIAL

Soil Conservation 1

RESEARCH ARTICLES

Studies on the Apple Characters of Cashew (Anacardium occidentale *L.*)—BY S. D. S. ALBUQUERQUE, M. VAZIR HASSAN AND K. RAGHU SHETTY 2

A Note on the Cytology of Some of the Species of the Genus Crotalaria, *Linn.*—BY C. KEMPANNA AND S. R. CHANDRASEKHARIAH 9

Mode of Egg-laying in Tingidæ (Hemiptera)—BY T. S. THONTADARYA AND G. P. CHANNA BASAVANNA 13

A Note on Rotations of Rabi *Crops in Dharwar District*—BY B. H. KATARKI AND A. L BANNATTI 15

Effect of Mixed Cropping of Groundnut with Laxmi *Cotton in the Transition Tract of North Karnatak*—BY S. V. PATIL AND V. R. KORADDI 20

"*G.S.* 560-1-1" *An Improved* Rabi *Jowar Variety for Dharwar District*—BY B. H. KATARKI 24

The Effect of Nitrogen, Phosphorus and Potash Application on the Yield of Jayadhar Cotton—BY S. V. PATIL AND G. V. HAVANAGI 29

Blast of Rice in Mysore—Trials with Fungicides for the Control of the Disease—BY N. S. VENKATAKRISHNIAH AND M. H. DELVI 33

GENERAL AND REVIEW ARTICLES

Stem Rot or Sclerotial Disease on Paddy Caused by Sclerotium oryzæ—BY H. KRISHNA ALVA 38

Cultivation of 170-Co_2 *Cotton under Irrigation in Mysore State*—BY V. R. REDDY 41

Groundnut Seed-Drill—BY V. M. MALLARAJ URS 44

News and Notes 48

Editorial

SOIL CONSERVATION

EVERY country is bestowed with various kinds of natural resources. Fertile soil is one such important natural resource of our country. Unlike the other natural resources, soil fertility can be inexhaustible if proper care is taken. Not only that, on the contrary, it can be enriched by proper soil management practices. It is the prime responsibility of every one concerned that this natural resource is passed on from one generation to another, at least in the same condition as it is received by him, if not after enriching it. But unfortunately it is far from being so. Soil in our country is getting depleted year after year. There is only exploitation and no conservation.

The first step in maintaining soil fertility is to conserve soil in its physical form, that is to prevent physical washing away of the soil. A Soil Conservation Board has been constituted at the national level and also in some States. A number of schemes have been formulated to tackle this nation-wide problem. It is not sufficient if the schemes are formulated on an *ad hoc* basis and executed through Governmental agencies only as is being done at present by hiring out labour. What is needed is an all-out drive on a war footing. It is seen that in some of the above soil conservation project, the farmer himself is not even present, when actual bunding is done in his own field even though he knows that he has to pay for that although not on the spot but in instalments. This shows that he is not aware of the magnitude of the problem and what part he has to play and for whose benefit. If these projects are to be merely executed like any other development projects by hired labour without active participation of the beneficiary himself the results may not be far-reaching. It is not even enough if he merely partakes in the bunding operation. As a lessee of a rich heritage, he has a great responsibility in this regard. It is, therefore, necessary to arouse interest in the farmers about soil conservation and educate them in the methods to be adopted by themselves for conserving soil. The various departments concerned have to play a major role in achieving this objective.

Research Articles

STUDIES ON THE APPLE CHARACTERS OF CASHEW (*ANACARDIUM OCCIDENTALE* L.)

By S. D. S. Albuquerque,[1] M. Vazir Hassan[2] and K. Raghu Shetty[3]

Introduction

The cashew apple is the swollen pedicel of the cashew-nut which is the real fruit. Numerous variations in its characters such as size, shape and colour are commonly met with. Among these the colour and size have been serving as rough guides in distinguishing between types. The occurrence of several intermediate forms between the common yellow, red, pink and white types with mixture of these colours in varying intensities render any attempt at a rigorous classification based on the apple colour alone impossible. Equally numerous are the variations, in the juice content of the apples, degree of sweetness, astringency, etc. Information is lacking on the exact degree of correlation, if any, between these characters and those of the nut. It is also not known whether such factors as the colour would give a broad indication of the degree of astringency of the apple or the yield of the tree. The somewhat popular belief that yellow apples are less astringent than red ones and that trees bearing yellow apples yield better than others have no precise data in support.

Apart from the value of this study from the point of view of classification it has to be recognized that the cashew apple is one of the important by-products of the cashew industry and it is but appropriate that alongside the work on the improvement of the nut which is the principal commodity, steps are also taken to improve the quality of the apples. A study of the apple characters was therefore undertaken at the Central Cashewnut Research Station, Mangalore, primarily with a view to guage the extent of variation in the apples and to study the relationship between each of the several characters within themselves and with reference to the nut.

[1, 2, 3] Cashew Research Station, Ullal, Mangalore.

Review of Literature

In a separate investigation Madhava Rao and Vazir Hassan[2] (1956) have set out the extent of variation noticed in the nut characters. Studies on the quantitative characters of cashew appels were made at the Agricultural Research Stations, Taliparamba and Nileshwar (Kerala State).[1] Anon (1954) with particular reference to the variation in the weight of fruits, weight of apple, weight and volume of juice per apple, etc., which revealed that the variations persisted from year to year pointing out the possibilities of evolving superior types by selection. Studiel on the desiccation of cashew apples[1] conducted at the Agriculturas Research Station, Nileshwar, revealed that the loss of weight was significantly more in red-coloured apples on exposure to sun. Morada[3] (1941) dealing with cashew culture in the Philippines found the apple forming 94% of the weight of the fruit. He says that in the cashew regions of Bataan there are two distinct types or varieties, namely, yellow-fruited and red-fruited types bearing several forms of fruits ranging from short turbinate to long turbinate or oblong ones. He has brought out a relationship between the size of the apple and astringency and finds the oblong apples more astringent. He concludes that the colour of the ripe fruits so far is the only distinguishing characteristic in identifying types.

Material and Methods

One thousand apples, collected from 100 trees spread over 5 different plantations near the Cashew Research Station, Mangalore, at the rate of 10 apples per tree during April 1955, formed the material for this study. The studies were repeated with the same number of apples from the same number of trees in April 1957 and confirmatory results were obtained. Of the thousand apples each examined during 1955 and 1957, 500 were distinctly yellow while the rest were distinctly red. Only fully ripe apples were selected.

Data were recorded on the following characters:—

(i) the maximum length and circumference of individual apples;

(ii) the weight of individual fruits (apples and nuts);

(iii) the weight of individual apples;

(iv) the juice content of individual apples;

(v) the astringency classified as 'not astringent', 'slightly astringent' and 'highly astringent'; and

(vi) firmness as judged by hand and classified into soft, medium and hard.

The data were also analysed to determine the correlation between (i) the size of apple and size of nut, (ii) the weight of apple and juice content, and (iii) the size of apple and juice content.

The correlation between the colour of the apple and the following apple characters were also studied:

(*a*) Astringency, (*b*) weight, (*c*) firmness and (*d*) juice content.

Results

It was observed from the study of the quantitative characters of 1,000 apples in 1955 and confirmed in 1957 that:—

(i) the maximum length of apples ranged from 3·3–7·3 cm. with a mean of 5·0 cm.;

(ii) the maximum circumferences of apples ranged from 11·2–19·6 cm. with a mean of 16·1 cm.;

(iii) the weight of fruits (apples and nuts) ranged from 0·6–4·0 oz. with a mean of 2·2 oz.;

(iv) the weight of apples ranged from 0·4–3·8 oz. with a mean of 2·0 oz.;

(v) the percentage of apple to fruit by weight ranged from 75–95 with a mean of 89·2%; and

(vi) the juice content of 'apples' ranged from 12–75 c.c. with a mean of 39·3 c.c.

The standard deviation and coefficient of variability with respect of length, circumference, weight of fruits, weight of apples, percentage of apple to fruit and juice content was worked out and the data are furnished in Table I.

Table I

Variation in apple characters

(Total number of apples examined: 1,000)

Character	Mean	Standard deviation	Coefficient of variability %
1. Weight of fruit in ounces (apple and nut)	2·2	0·62	26·4
2. Weight of apple in ounces	2·0	0·61	30·5
3. Maximum length of apple (cm.)	5·0	0·93	18·6
4. Maximum circumference of apple (cm.)	16·1	1·90	11·8
5. Percentage of apple to fruit	89·2	2·90	3·3
6. Juice content per apple (c.c.)	39·3	14·5	37·0

It would be seen from Table I that while a high degree of variation is noticed in most of the characters the percentage of apple to fruit, namely, 89·2 seem to be fairly uniform, the coefficient of variability being only 3·3%.

Correlation between apple and nut characters.—The following are the results of the correlation studies between the apple and nut characters:—

TABLE II

Correlation between apple and nut characters

	Particulars	Standard error	Correlation coefficient	Remarks
1.	Size of apple and size of nut	0·09	+0·6	Highly significant
2.	Weight of apple and weight of nut	0·11	0·2	Not significant
3.	Weight of apple and juice content	0·06	+0·9	Highly significant
4.	Size of apple and juice content	0·08	+0·6	Do.

It would be seen from Table II that:

(i) larger the apple, larger the nut;

(ii) heavier the apple, higher is the juice content;

(iii) larger the apple, higher is the juice content; and

(iv) there is no correlation between the weight of the apple and the weight of the nut showing that a fruit with a heavy apple need not carry a heavy nut also.

Correlation between apple colour and other characters.—The following results were recorded in the studies to determine the relationship between the apple colour and (i) astringency, (ii) weight, (iii) firmness, and (iv) juice content.

It is apparent from Table III that though astringency is seen both in yellow and red apples a large proportion of yellow apples is completely free from astringency.

Apple colour and apple weight.—The mean weight of a red apple was 1·9 oz. and that of an yellow apple 2·2 oz. The difference

TABLE III

Apple colour and astringency

(Number of apples examined in each colour = 500)

Colour of the apple	Number of apples that were			
	Not astringent	Slightly astringent	Highly astringent	Total
Red ..	40	390	70	500
Yellow ..	130	320	50	500
TOTAL ..	170	710	120	1000

X^2 for 2 d.f. = 11·576.**

** Highly significant.

between the two mean was satistically significant as seen from Table IV indicating thereby that *heavier apples were more frequently seen in the yellow group.*

TABLE IV

Apple colour and apple weight

Colour of apple	Mean weight (oz.)	Difference between means (D)	S.E. of the difference between means (ED)	D/ED	't' from tables	Significant or not
1. Red	1·9	0·3	0·12	2·5	1·96	Significant
2. Yellow	2·2					

Apple colour and juice content.—An yellow apple weighing an ounce contained a mean of 19·5 c.c. of juice while a red apple of the same weight contained 20·2 c.c. of juice. The difference was however not statistically significant as seen from Table V.

It is seen from the data below that yellow apples are often softer than red ones. This also supports the indication that red apples are more juicy which accounts for their firmness. Yellow apples though heavier are less juicy and are obviously larger in size and more 'fluffy' than red ones.

TABLE V

Apple colour and juice content

Colour of apple	Mean juice content	Difference between means (D)	S.E. of the difference between means (ED)	D/ED	't' from tables	Significant or not
1. Red	20·2	0·7	0·9	0·77	1·96	Not significant
2. Yellow	19·5					

TABLE VI

Apple colour and firmness

(Number of apples examined in each colour = 500)

Colour	Number of apples			
	Firm	Medium	Soft	Total
1. Yellow ..	100	70	330	500
2. Red ..	130	260	110	500
TOTAL ..	230	330	440	1000

X^2 for 2 d.f. = 44·661.**

** Highly significant.

DISCUSSION

The variation noticed in the weight, length, circumference and juice content of the 'apple' is as large as anticipated. The proportion of the apple to the total fruit weight seems, however, to be fairly constant. While the significant correlation between the size of apple and size of nut and size as well as weight of apple and juice content may serve as useful guides, it is interesting to note that a fruit with a heavy apple need not bear a heavy nut. The observations on the astringency of apples in relation to this colour have positively proved that a larger proportion and yellow apples are non-astringent. The data, therefore, lend support to a similar belief which is popularly held among growers. It is also interesting to note that yellow apples are

often heavier than red ones. In regard to the juice content, however the differences are not significant. The softness of yellow apples and the firmness of red ones are also indicated.

The cashew apple is an important by-product of the cashew-nut industry and steps are being taken to devise the best means of utilising it. It would be useful to perpetuate only such types as would cater to the needs of the by-product industry, as those characterized by juiciness, minimum astringency, etc. These are likely to be important factors in the choice of suitable types. The correlation studies may be expected to serve as useful guides in selection of the apples.

A definite correlation between the colour of apple and the yield of the tree is claimed by many growers; trees bearing yellow apples are believed to yield better. Definite information on this aspect is likely to be of great benefit, at least in respect of trees bearing apples distinctly red or yellow in colour.

Summary

1. One thousand cashew apples collected during April 1955 from 100 trees from 3 plantations were studied at the Central Cashew-nut Research Station, Mangalore. Confirmation studies were carried out in April 1957.

2. Wide variation was noticed in the weight, size, juice content, etc., of the apples.

3. Larger the apples, larger the nuts. Heavier and larger the apple, higher the juice content.

4. Yellow apples are often less astringent, heavier and softer than red apples.

Acknowledgements

The authors are thankful to Sri. V. Madhava Rao, in whose period the work was initiated and to Sri. C. M. Bhaktavatsala, Statistical Assistant, Agricultural College and Research Institute, Coimbatore, for his assistance in the analysis of the data. The paper includes part of the work done at the Central Cashew-nut Research Station, Mangalore, which is partly financed by the Indian Council of Agricultural Research.

References

1. Anon (1954), *Memoirs of the Department of Agriculture, Madras*, Superintendent, Government Press, Madras.
2. Madhava Rao, V. N. and Vazir Hassan, M. (June, 1956), "Studies on the Seed Characters of Cashew," *Indian Journal of Agricultural Science*, **26** (2).
3. Morada, E. K. (1941), "Cashew Culture," *Philippine Journal of Agriculture* **12** (1).

(Received: 20th November 1959)

A NOTE ON THE CYTOLOGY OF SOME OF THE SPECIES OF THE GENUS *CROTALARIA*, LINN.

By C. Kempanna[1] and S. R. Chandrasekhariah[2]

Introduction

The genus *Crotalaria*, Linn. belongs to the tribe Genisteæ, subfamily Papilionatæ, comprises as many as 325 species and is distributed all over the world (Bailey, 1949). Its wide distribution all over the world seemed to have obliterated correct diagnosis of the species and created taxonomic confusion. For instance Rao (1950) refers *Crotalaria striata*, D.C. to *Crotalaria mucronata* Desv. though there are visible differences between the two in their morphological features. Similarly, *Crotalaria brownii*, Bert. despite its similarity to *C. striata* in most of its characters is classified as a separate species. In most of the species the chromosome number is not reported as yet. Even in those species where chromosome number is reported, variation is observed. Further, existence of more than one haploid numbers in the genus is a matter of interest.

Clear understanding of the cytogenetical relationships between the groups for a proper evolution of breeding programme to achieve several objectives is a prime need and hence the present study was taken up in the Agricultural Research Station, Hebbal, Bangalore, during 1959.

Morphological Studies

The morphological studies made on *C. striata*, *C. brownii*, and *C. mucronata* which show some similarities and dissimilarities between themselves have been recorded in Table I.

From the data in Table I, it is apparent that *C. striata* do not differ much from *C. brownii*, while it differs from *C. mucronata*, so far as its morphological features are concerned. Whether the similarities and dissimilarities recorded between these species will be sufficient to consider these as separate entities or the forms of the same entity is difficult to state at this stage. However, this could very well be ascertained through cytogenetical studies of their respective hybrids and the work in this direction is in progress.

[1, 2] Division of Botany, Agricultural College, Hebbal, Bangalore–6.

TABLE I

Character	*C. striata*	*C. brownii*	*C. mucronata*
Habit	Bushy	Bushy	Bushy
Stem	Cylindrical, green, purple colour extending from the axil to about 1″ to 2″ and also in patches up to 1st node on the branches	Cylindrical, green, purple colour confining to axils of branches and leaves	Cylindrical, green, purple colour at the axils of branches and leaves
Height	4′ 6″	4′ 6″	3′ 0″
Stipules	Erect	Minute white, hairy	Curved
Leaves	Ovate, acute apex, mucronate tip, dark green	Ovate, acute apex, mucronate tip, dark green	Obovate obtuse mucronate tip, light green
Size of leaf	43·8 sq.cm.	26 to 30 sq.cm.	18 sq.cm.
Length of the petiole	6·5 cm.	4·5 cm.	2·5 cm.
Length of the inflorescence	36 cm.	35 cm.	19·3 cm.
No. of flowers in an inflorescence	150–200	150–200	45–50
Colour of the flower	Pure yellow, in some cases purple streaks are found	Similar to *C. striata*	Orange yellow with dark purple streaks on all the petals on anterior side
Pod	Straight pod with curved beak, slightly cylindrical	Curved, style persistent, cylindrical	Curved pod, style persistent, flat
Seeds	35–45 per pod	30–36 per pod	28–30 per pod

Cytological Studies

The cytological information available with regard to this genus is very meagre except reporting of chromosome numbers in some of the species. The chromosome numbers in the following species were checked up and the cytology of them has been studied in detail. The flower-buds were fixed in acetic alcohol (1 :3) and smeared in acetocarmine for meiotic studies. Mordanting with iron acetate gave better results than otherwise.

Sl. No.	Species	Source	Previous No. *n*	Present No. *n*
1	*Crotalaria juncea*, L.	Different places in India	10	8
2	*Crotalaria striata*, D.C.	do.	8	8
3	*C. brownii*, Bert.	Coimbatore, Mysore	16	8
4	*C. mucronata*, Desv.	Florida (U.S.A.), Kasargod (India)	..	8
5	*C. biflora*, L.	Bangalore	8	8
6	*C. lanceolata*, Roxb.	Florida (U.S.A.)	8	8
7	*C. intermedia*, Kotschy	do. Kasargod (India)	8	8
8	*C. goreensis*, Guille perr.	Mangalore	..	8
9	*C. lanata*, Bedd.	Bangalore	..	8
10	*C. fulva*, Roxb.	do.	8	8
11	*C. sericia*, Retz.	do.	8	8
12	*C. usaramoensis*, Baker.	do. Florida	8	8
13	*C. anagyroides*, H.B. and K.	Bangalore	8	8
14	*C. retusa*, L.	do.	8	8
15	*C. incana*, L.	Kasargod	7	7

Dutta (1933) has reported the chromosome number of *C. juncea* as $2n = 20$. But it is not at all found in about 30 cultures obtained from different parts of India ; instead, $2n = 16$ is uniformly recorded in all the cultures. Similarly, Srivatsava (1958) states that the chromosome number of *C. brownii* is $2n = 32$. This number is also not met with in the material collected from Mysore and Coimbatore (South India), which show only 16 diploid chromosomes. In other species the chromosome numbers are tallying with those reported earlier.

The earliest phase in which the chromosomes were visible was diplotene. In diakinesis and I Metaphase, formation of 8 bivalents

in the 16 chromosome species and 7 bivalents in the 14 chromosome species was obvious. In the former group 7 ring bivalents and one rod bivalent were invariably found as against only 7 ring bivalents in the latter group. In diplotene and diakinesis only one bivalent was found to be attached to nucleolus in both the groups. The pairing behaviour in 32 chromosome species could not be ascertained as the same was not available in the cultures maintained here. The orientation of bivalents on the first metaphase was regular. Subsequent stages were normal in most of the species. But, in *C. sericia* and *C. usaramoensis*, the I Anaphase cells were found with bridges to the extent of about 10% and 12% respectively. These bridges were not accompanying the fragments. The perpetuation of these bridges in the II Anaphase was noticed in *C. sericia* to the extent of 3% while the same was absent in *C. usaramœnsis*. The bridge formation in *C. sericia* has been reported by Roy and Sinha (1959). According to them, the bridge-like formation is due to a lagging bivalent. However, in the present study, the thin chromatin bridge was seen to have extended from one pole to the other uniformly. This indicates that the bridge is a chromatin bridge but not a bridge formed either by a full chromosome or a bivalent as the bridge formed by a full chromosome or a bivalent appears much thicker than the one formed out of chromatids. In the circumstances it is possible to assume that the bridges noticed may be fusion bridges only as no serious setbacks have been noticed in the subsequent stages of the meiosis and the pollen is fully fertile.

To find out the interrelationships between the 16 chromosomed and 14 chromosomed species, number of crosses have been made and their hybrids are under study.

Acknowledgment

We are highly grateful to Shri B. Venkoba Rao, Principal, Agricultural College, Hebbal, Bangalore, for his encouragement and for providing facilities to carry on the work.

References

Bailey, L. H. (1949), The MacMillan Co., New York.

Dutta, R. M. (1933), *Curr. Sci.*, **2**, 67.

Rao, Y. S. (1950), *Ibid.*, **19**, 384.

Roy, S. P. and Sinha, R. P. (1959), *Ibid.*, **28**, 253.

Srivatsava (1958), *Cytologia*, **23** (2), 193–99.

(Received : 24th January 1960)

MODE OF EGG-LAYING IN TINGIDÆ (HEMIPTERA)*

By T. S. Thontadarya[1] and G. P. Channa Basavanna[2]

According to Imms (1957) Tingid bugs insert their eggs into plant tissue. Patel and Kulkarny (1955) who studied the bionomics of the brinjal tingid, *Urentius echinus* Dist., Sharga (1953) and Samuel (1939) who studied the egg. laying habit of *Monanthia globulifera* Wlk. have merely stated that the eggs are inserted into the leaf tissue, and none of these workers have mentioned about the actual mode of thrusting the eggs into the plant tissue and what precedes the deposition of eggs. The purpose of the present note is to bring to the notice of the workers on this group an apparently unknown sequence of a series of actions on the part of the female Tingid culminating in the deposition of an egg which is inveriably preceded by extensive probing and actual marking by the rostrum.

The tingids included in the present study are : (1) *Galeatus* sp. on *Barleria cristata.*, (2) *Urentius echinus* Dist. on brinjal and (3) *Monanthia globulifera* Wlk. on *Coleus* sp. The three species lay eggs inserted into the plant tissue of tender portions of their host plants. The ovipositor is well developed, dagger-shaped, and pointed at the tip While ovipositing, the female bug in all these species follows an uniform procedure, the exact significance of which is not clearly understood. Before depositing an egg, the female moves about on the surface of the leaf or tender twig, all the time probing by means of the tip of her rostrum, and occasionally even inserting the stylets into the plant tissue and drawing them out. Finally, perhaps on finding a suitable site for egg-aying, the stylets are driven deep with their entire length inside the plant tissue. With her stylets still inside the plant tissue she moves her body forward, with the location of the legs not changed or very slightly changed. This is brought about by mere changing the inclination of the legs, which were inclined backwards formerly are now leaning forwards carrying the body with them. Then the stylets are withdrawn from the plant tissue as though with some difficulty. The ovipositor, as a whole, is slowly drawn out from underneath the abdomen, so that it almost assumes a perpendicular position to the abdomen. The tip of the ovipositor begins probing, obviously in search of the

---

* Originally published in *Nature* dated 25–7–1959 and reproduced with due acknowledgements.

[1, 2] Division of Entomology, Department of Agriculture, Bangalore.

puncture made by the stylets collectively, to insert an egg, and unless the bug locates this puncture by means of the tip of the ovipositor she does not lay an egg, and moves on to find another suitable place. The ovipositor is inserted through the same puncture and the entire length is driven into the plant tissue. Now a series of alternate distention and contraction of the abdomen and a sort of slight pumping action culminates in the deposition of an egg and simultaneous withdrawal of the ovipositor from the plant tissue. During the process of egg-laying the abdominal tip is very near the surface of the plant and the body is inclined at 30° to the plant surface. The opercular end of the egg will be just visible at the surface of the plant. The entire process commencing from probing by means of the rostrum to the withdrawal of the ovipositor takes 3 to 4 minutes.

The significance of the rostrum taking part in oviposition in these Tingids is not clearly understood.

Further work on the egg-laying habit in different forms of the group, and the significance of this process is being pursued.

Grateful thanks are due to Dr. M. Puttarudriah, Government Entomologist, for providing facilities and encouragement.

References

Imms, A. D. (1957), *A General Textbook of Entomology*, Methuen, London, Pp. 886.

Patel, R. C. and Kulkarny, H. L. (1955), *J. Bomb. Nat. Hist. Soc.*, **53** (1), 86–96.

Sharga, U. S. (1953), *Ibid.*, **51**, 885–89.

Samuel, C. K. (1939), *Ind. J. Ent.*, **1** (3), 98–99.

(Received: 4th December 1959)

A NOTE ON ROTATIONS OF *RABI* CROPS IN DHARWAR DISTRICT

By B. H. Katarki[1] and A. L. Bannatti[2]

Introduction

The role of judicious crop rotations in maintenance of soil fertility and higher per acre yields has been stressed by many authors as a valuable agronomic practice in crop culture. Arakeri (1951) reviewing the literature on crop rotations in foreign countries has concluded that the sequence of crops in any rotation is very important and is the main cause of increase or decrease in yields due to different rotations and further points out that, as very little data are available on this aspect of agronomy under Indian conditions, immediate steps should be taken up to fix up suitable rotations for each tract of every State, not only to increase per acre production but also in the maintenance of soil fertility at the desired level.

With a view to fix up suitable rotations for *Rabi* crops for the dry belt of Dharwar District, a feeler trial has been laid out at Agricultural Research Station, Annigeri, since 1956–57 season. The available results are discussed in the present note.

Material and Methods

The important *Rabi* crops of Dharwar District are *Rabi* Jowar, Wheat, Cotton and Gram and their improved varieties which are under cultivation in Navalgund, Gadag and Ron talukas and Nargund Petha have been selected for study with following five treatments at the Agricultural Research Station, Annigeri.

Crop	Variety
(1) *Rabi* Jowar	G.S. 560–1–1
(2) Wheat	*Kenphad*
(3) Cotton	*Laxmi*
(4) Gram	*Chaffa*
(5) *Rabi* Jowar and Gram as row crop	G.S. 560–1–1 & *Chaffa*

[1] [2] Agricultural Research Station, Annigeri, Dharwar District.

The following design has been selected with only one replication because this being a feeler trial:—

Plan for the first year

B	A	E	D	C
1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

A, B, C, D, E refer to the crops while 1, 2, 3, 4, etc., refer to plot numbers.

Plan for the second year

B	1	2	3	4	5
C	6	7	8	9	10
A	11	12	13	14	15
B	16	17	18	19	20
E	21	22	23	24	25

The treatment regarding cultural operations, manuring, etc., was normal for the entire experiment. Ploughing once and harrowing five times was adopted every year. Five cartloads of F.Y.M. per acre was applied uniformly each year for the whole experimental plot. As per sowing plan for first year, each crop is sown vertically, while during the succeeding year, the crops are taken horizontally so that each crop will have the rotational effect of every crop in the second

year. In the third year the design of the experiment was similar to that of first year.

The unit plot measures 33′×33′ which is equal to one gunta (1/40 acre).

Results

The experiment was started in the year 1956–57 and at present three years' results are available. The results of the first season, *i.e.*, 1956–57 are of no use for the purpose as there was only one crop throughout the experimental area in the previous season. The average results of second and third seasons are presented in Table I.

Table I

Rotational effects of certain crops on yields of succeeding crops

(Average of two seasons, *i.e.*, 1957–58, 1958–59)

Sl. No.	Previous crops	Succeeding crops (per acre yields in lb.)				
		Cotton	*Rabi* Jowar	Wheat	Gram	Rabi Jowar *plus* Gram
1	2	3	4	5	6	7
1	Cotton	642	667	553	540	227+350
2	*Rabi* Jowar	482	340	470	510	152+320
3	Wheat	650	891	575	530	310+370
4	Gram	700	820	485	460	298+330
5	Rabi Jowar + Gram	477	750	292	430	370+230

The results indicate the following:

(1) Cotton has beneficial effects on the succeeding crops of Wheat and Gram.

(2) *Rabi* Jowar has deleterious effects on all the succeeding crops involved in the experiment except Gram which suffers least.

(3) Wheat produces beneficial effects on all the succeeding crops involved in the experiment including Wheat.

(4) Gram produces beneficial effects on the succeeding Cotton and *Rabi* Jowar only.

(5) *Rabi* Jowar and Gram mixture produces also deleterious effects on all the succeeding crops. The succeeding crops of *Rabi* Jowar or *Rabi* Jowar-Gram mixture do not suffer to such a high degree in yield as compared to that of Cotton or Wheat. Probably the inclusion of Gram as a row crop in Jowar may be reducing the ill-effects of Jowar for the succeeding crops of *Rabi* Jowar or *Rabi* Jowar and Gram mixture.

Discussion of the Results

A feeler rotational experiment for *Rabi* Jowar with Gram and Wheat conducted at the Agricultural Research Station, Mohal, indicates that the *Rabi* Jowar after Gram is better than other rotational combinations (Pandya and Chavan, 1954). Rotational experiments, conducted at the Agricultural Research Stations, Bijapur and Mohal, from 1946–47 to 1951–52, have proved that Wheat after gram yields best (Argikar and Patil, 1956). Further the authors report that Wheat after Wheat on the same land too is good enough in planning a cropping programme. Wheat grown after Jowar suffers badly. Yeligar *et al.* (1958) report that yields in continuous Jowar crop manured with F.Y.M. in alternate years reduces the yields of grain and *Kadabi* of Jowar considerably as compared to normal Jowar yields in Jowar Cotton rotations and further state that loss in grain yield can be made good by manuring with F.Y.M. every year. Divekar and Kurtkoti (1958) state that Cotton yield in continuous Cotton manured in alternate year is found to yield lower by 11·27% per year as compared to normal Cotton in Jowar-Cotton rotation and further impress that the low Cotton yields can be corrected by manuring with F.Y.M. every year. The authors further state that in three-way rotations of Jowar and Cotton succeeding Groundnut yield 58·7% and 32·01% more respectively as compared to normal yields of Jowar and Cotton in Jowar-Cotton rotation.

On the whole, it is seen that *Rabi* Jowar or Wheat succeeding Gram is best while Wheat after Wheat is also considered as a feasible rotation. *Kharif* Jowar or Cotton succeeding Groundnut is also best in the tract where Groundnut is a major crop. Thus, it is seen that Groundnut or Gram serves as very useful crops for rotations with Jowar, Cotton and Wheat.

The results presented in the present note indicate that the *Rabi* Jowar and Cotton succeeding Wheat or Gram is better than other rotations. Secondly, Wheat and Gram succeeding Cotton or Wheat is also found to be beneficial. Cotton after Cotton in this tract is better

than Cotton after *Rabi* Jowar or *Rabi* Jowar-Gram mixture. It is also seen that introduction of Gram as a raw crop in *Rabi* Jowar is beneficial to succeeding crops of *Rabi* Jowar or *Rabi* Jowar-Gram mixture. However, Wheat and Gram crops form a very important link in the rotational systems of *Rabi* crops in dry Semi-arid belts of deep black soils of Dharwar District. Jowar after Jowar and Gram after Gram should be avoided as, such a practice not only reduces the yields considerably but also gives an impetus for recurrence and severity of pests and disease like stem-borer on Jowar and wilt in Gram. The ill-effects of Sorghums on the succeeding crops have been amply demonstrated by Sewell (1923), Breazeale (1924) and Ayyar and Sundaram (1941). Cotton after Cotton and Wheat after Wheat may be taken if necessary under unavoidable circumstances to certain advantage. These are some of the indications observed from the available data of two seasons. But, however, the experiment will be continued for two seasons more to confirm the above findings.

Summary

A feeler trial was laid out with the important *Rabi* crops of the tract in the season 1956–57 and continued at the Agricultural Research Station, Annigeri of Dharwar District. The average results of the experiment for 1957–58 and 1958–59 indicate that the rotations like *Rabi* Jowar-Gram, Wheat-Cotton and Cotton-Wheat-Gram can be adopted to advantage in the *Rabi* tract of Dharwar District.

References

1. Arkeri, H. R. (1951), "Effects of certain crops on the succeeding crop," *Poona Agricultural College Magazine*, **42** (3), 115–22.
2. Argikar, G. P. and Patil, T. A. (1957), "Agronomic practices for increasing wheat yields," *Ibid.*, **47** (4), 235–40.
3. Ayyar, V. R. and Sundaram, S. (1941), "A brief account of studies on the harmful after-effects of cholum crop on cotton," *Ind. Jour. Agric. Sci.*, **11**, 37–52.
4. Breazeale, J. F. (1924), "The injurious after effects of Sorghum," *J. Am. Soc. Agron.*, **16**, 689–700.
5. Divekar, C. B. and Kurtkoti, F. B. (1958), "Effects of various rotations on the cotton crop," *Mys. Agri. Jour.*, **33** (4), 202–08.
6. Pandya, P. S. and Chavan, V. M. (1954), "Brief note on research work done on jowar in Bombay State," *Poona Agricultural College Magazine*, **45** (2), 71–74.
7. Sewell, M. C. (1923), "Effects of *Andropogan sorghum* on succeeding crops of *Triticum vulgare*," *Bot. Gaz.*, **75**, 1–26.
8. Yeligar, B. S., Kurtkoti, F. B. and Divekar, C. B. (1958), "Effects of various rotations on jowar," *Mys. Agri. Jour.*, **33** (4), 202–08.

(Received: 30th October 1959)

EFFECT OF MIXED CROPPING OF GROUNDNUT WITH *LAXMI* COTTON IN THE TRANSITION TRACT OF NORTH KARNATAK *

By S. V. Patil[1] and V. R. Koraddi[2]

Mixed cropping is an age-old practice in India. The mixed cropping is growing of two or more crops together in the field. The advantages of mixed cropping have been well understood by the cultivators and the practice is followed with considerable success for various crops grown in India. Of the various practices of mixed cropping, growing of cotton and groundnut as mixed crops is commonly followed by the cultivators in the transition tract of North Karnatak. These crops are grown as mixed crops both on light and black soils in Hukkeri, Gokak, Parasagad and Sampagaon talukas of Belgaum District and Haveri, Hirekerur, Hangal, Ranebennur, Hubli, Siggaon talukas and Byadagi-mahal of Dharwar District. Generally, erect and early variety of groundnut is grown as a mixed crop with *Laxmi* cotton and to a small extent with Jayadhar cotton. At present, the market rates for groundnut are quite favourable and as such this practice of mixed cropping is rapidly increasing. With a view to study the effect of mixed cropping on the yield of cotton and to try different proportions of groundnut mixture aiming at higher income, investigations were carried out at the Agricultural College Farm, Dharwar, and the details are presented in this paper.

Review of Literature

Aiyer (1953) and Raheja (1957) have discussed the merits of mixed cropping and the various practices of mixed cropping followed in India. Tippannavar and Patil (1952) have reported that when cotton (Jaywant) and groundnut (erect type) are grown in alternate rows, the yield of cotton is reduced by 34%. But, however, the cotton and groundnut mixture gave higher monetary return than cotton alone. Further it is reported that, the yield of subsequent crop of Jowar, after cotton and groundnut mixture was increased by about 7% as compared to Jowar taken after cotton alone. The trials conducted at Indore (1956) with inter-cropping of groundnut and cotton have indicated that yield of

[1, 2] Agronomy Section, College of Agriculture, Dharwar.

* Paper presented at the 9th Conference on Cotton Growing Problems in India, Dharwar 1958. Reproduced with permission of the Indian Central Cotton Committee, Bombay.

groundnut pods and money return from one row of cotton and give rows of groundnut was not significantly lower than the control of groundnut alone.

Materials and Methods

The experiment on mixed cropping of groundnut and *Laxmi* cotton was carried out for the years from 1955 to 1958 on black soil at the Agricultural College Farm, Dharwar, situated in the transition tract. The experiment consisted of four treatments as follows:

(1) Cotton alone

(2) Cotton and Groundnut (Spanish Improved) 1 : 1

(3) „ „ 1 : 2

(4) „ „ 1 : 3

The layout followed was randomised block with 6 replications. The erect variety of groundnut (Sp. Improved) was sown in June–July and *Laxmi* cotton in August–September. The groundnut crop was harvested in October and the interspace between two lines of cotton was regularly intercultivated and the cotton crop was harvested in February–March.

The annual rainfall on the College Farm is about 30 inches. The rainfall received during the three years when the experiment was conducted is given in Table I.

Table I

Rainfall in inches at the Agricultural College Farm, Dharwar, 1955–56 to 1957–58

Month	1955–56	1956–57	1957–58	Average of 7 years
April	0–74	2–45	1–60	2–50
May	8–22	1–07	5–06	2–70
June	5–23	4–61	3–62	3–20
July	2–07	6–88	5–20	7–60
August	2–18	5–66	8–50	3–80
September	8–16	3–35	1–60	3–20
October	7–15	11–18	7–60	7–20
November	..	5–67	2–60	0–80
Total ..	33–75	40–57	36–08	31–00

During 1956–57, the cotton crop was severely affected because of heavy rains and as such the yields were very low.

Results and Discussion

The yield of *Laxmi* cotton and groundnut, along with money returns for different treatments, is given in Table II.

Table II

Effect of mixed cropping of cotton and groundnut on the yield and income

Treatments	1955-56			1956-57			1957-58		
	Cotton	Ground-nut	Total income	Cotton	Ground-nut	Total income	Cotton	Ground-nut	Total income
			Rs.			Rs.			Rs.
Cotton alone ..	471	..	219	79	..	36	467	..	218
Cotton and Groundnut 1 : 1	281	512	224	76	1951	392	282	1134	338
do. 1 : 2	242	594	211	64	1783	356	227	1244	333
do. 1 : 3	206	635	212	109	1965	410	158	1405	329

Rates : Cotton Rs. 525 for 1,344 lb ; Groundnut Rs. 15 for 82 lb.

The results indicate that in normal years the yield of cotton goes on decreasing and that of groundnut increasing as the number of lines of groundnut go on increasing. The yield of *Laxmi* cotton is reduced by about 40% when the groundnut is taken as a mixed crop in alternate lines as compared to growing of cotton alone. From the monetary return point of view growing of cotton and groundnut in alternate lines normally gives the highest money returns. Hence when the rates of groundnut are more than about Rs. 13 per Bengali maund the growing of cotton and groundnut in alternate rows may be more profitable than growing cotton alone.

During 1956–57 *Laxmi* cotton suffered severely due to heavy rainfall in the month of October. The crop suffered from black-gram and the yields were very poor. However the yield of groundnut was quite high. So the practice of mixed cropping besides giving additional income in the normal years has other advantages that it ensures some monetary gains during the years when the *Laxmi* cotton fails due to unfavourable conditions like heavy rain and attack of diseases which

is not uncommon in this tract. Another advantage is that the cultivator could expect some income early during the season as the groundnut crop would be harvested in October, otherwise when he takes entire cotton he has to wait till March. Because of these advantages this practice of mixed cropping is getting common both in black and light soils. The investigations on mixed cropping in light soils have been started during 1957 and the work is in progress.

Summary

The experiment on mixed cropping of cotton and groundnut carried out in black soils is presented. Growing of cotton and groundnut in alternate lines in normal years has given higher monetary returns than growing cotton alone or growing two lines or three lines of groundnut after every line of cotton. The yield of cotton is reduced by about 40% when groundnut is grown in alternate lines. Growing of cotton and groundnut mixture however ensures against monetary loss in cultivation in case the cotton crop fails because of certain unfavourable conditions.

References

1. Aiyer, A. K. Yegna Narayan (1953), *Principles of Crop Husbandry in India*, pp. 341–50.
2. Annonymous (1956), "Indian Central Cotton Committee," *Thirty Fifth Annual Report*, pp. 33–34.
3. Thippannavar, M. B. and Patil, S. V. (1952), "Retrospect and prospect of cotton cultivation in Bombay Karnatak," *Indian Cotton Growing Review* **6** (1).

"G.S. 560-1-1" AN IMPROVED *RABI* JOWAR VARIETY FOR DHARWAR DISTRICT

By B. H. Katarki*

Introduction

Next to Bijapur and Gulburga, Dharwar District commands largest acreage under Jowar (*Sorghum vulgare* Pers.) in Mysore State. Both *kharif* as well as *rabi* Jowar varieties are grown on an area of 5·90 lakhs and 1·17 lakhs of acres respectively. Cultivation of *rabi* Jowar is mostly restricted to Gadag, Ron, Navalgund talukas and Nargund Petha of Dharwar District. *Yenigar* a *rabi* Jowar variety with compact panicle, pearly grains and good fodder quality was under cultivation in these talukas. Since 1957–58 season, G.S. 560–1–1 an improved *rabi* Jowar variety is slowly replacing the local *Yenigar* in these talukas of Dharwar District.

Research Work in Retrospect

With the inception of the Agricultural Research Station at Annigeri in 1947, the improvement work in *rabi* Jowar was taken up. Various local *Yenigar* bulks were collected from *Yenigar* belt and studied. It was revealed that the material had lot of variability for yield, grain and glume characters. As such, the material was subject to exploitation and three strains, *viz.*, Y-417-5, Y 2 and G.S. 560–1–1 were isolated. The performance of these strains under farm as well as cultivators' field trials carried out for a period of 3 years from 1952–53 to 1954–55 were in favour of Y-417-5 (Chavan, Kajjari, Kurtakoti, 1955).

Further Progress of Work and Results Obtained

Subsequent comparative tests were undertaken both on the farms as well as in cultivators' fields from 1955–56 season and the results obtained are tabulated in Table I.

The other ancillary data collected on plants and panicle characters of these *Yenigar* selections are presented in Table III along with local *Yenigar* bulk (Appendix).

---

* Agricultural Demonstrator, I/C Agricultural Research Station, Annigeri Dharwar District.

TABLE I

Farm trials

Sl. No.	Variety	Seasons	No. of days to flower	Per acre grain yield in lb.	100 Grain wt. in gm.
1	2	3	4	5	6
1	G.S. 560–1–1	1955–56	85	1,580	3·65
		1956–57	123	1,092	3·20
		1957–58	82	1,275	3·17
		1958–59	79	1,596	2·70
		Average	92·2	1,386	3·18
2	Y–417–5	1955–56	76	1,560	2·67
		1956–57	102	1,092	2·75
		1957–58	79	1,121	2·85
		1959–60	73	1,537	2·60
		Average	82	1,327	2·72
3	Local	1955–56	85	1,500	3·10
		1956–57	123	984	2·70
		1957–58	82	1,168	2·67
		1958–59	81	1,448	2·82
		Average	92·7	1,275	2·82

DISCUSSION OF RESULTS

The average results of farm trials (*vide* Table I) conducted for four seasons from 1955–56 to 1958–59 indicate that *Yenigar* selections G.S. 560–1–1 and Y-417-5 yield 8% and 4% more than local *yenigar* respectively. Secondly, it is important to note that G.S. 560–11– possess definitely bold grains as compared to Y–417–5 and *Yenigar* local varieties. Y–417–5, however, is earlier by 10 days than both the varieties under test. Herein, it may be mentioned that G.S. 560–1–1 had also yielded better in 1953–54 and 1954–55 seasons than Y–417–5 and local *Yenigar* at farm trials and its percentage of increase over

local is 22% as against 11% of Y-417-5 (Chavan, Kajjari and Kurtkoti, 1955).

The available results of district trials (*vide* Table II) also confirm the supariority of G.S. 560-1-1 over local variety. Y-417-5 was under

TABLE II

Grain yields under district trials

Sl. No.	Taluka	Seasons	No. of trials	G.S. 560-1-1	Local	Y-417-5
1	2	3	4	5	6	7
1	Navalgund	1955-56	1	298	264	244
		1957-58	1	490	395	..
		1958-59	1	572	550	..
		Average		453	403	244
2	Gadag	1955-56	3	446	438	403
		1957-58	1	1,070	1,040	..
		Average		758	739	403
3	Ron	1953-54	1	420	320	..
		1954-55	2	355	382	286
		Average		387	351	286
		Grand Mean		533	498	311

district trials only during 1955-56 and dropped from inclusion in the subsequent seasons due to its unsatisfactory performance. G.S. 560-1-1 has yield 11% more in Navalgund taluka, 2% more in Gadag taluka and 9% more in Ron taluka than local *Yenigar* variety.

From other ancillary data of four seasons tabulated in Table III, it is observed that G.S. 560-1-1 plant is taller and thicker than Y-417-5. As regards panical characters, Y-417-5 possesses bold but semi-compact panicle, while G.S. 560-1-1 possess bold but compact panicle as compared to that of Local variety. Besides, G.S. 560-1-1 possess bright white grain colour,

TABLE III

Plant and panical characterstics of G.S. 560-1-1 and Y-417-5 V/S local Yenigar (1955-1956 *to* 1958-1959)

Sl. No.	Varieties	Seasons	Ht. of plant in cms.	Girth of plant in cms.	No. of leaves per plant	Length of leaf	Breadth of leaf	Midrib colour	Texture of panicle	Length of panicle	Breadth of panicle	Grain colour
1	2	3	4	5	6	7	8	9	10	11	12	13
1	G.S. 560-1-1 ..	1955-56	119·0	3·4	8·0	51·0	5·0	White	Compact	10·0	5·0	Bright white
		1956-57	119·0	4·3	7·0	48·0	5·9	do.	do.	11·0	6·0	do.
		1957-58	157·7	3·7	8·8	57·9	6·7	do.	do.	10·1	5·4	do.
		1958-59	213·5	5·3	11·2	71·2	6·9	do.	do.	11·2	5·4	do.
		Average	152·3	4·2	8·7	57·0	6·1	do.	do.	10·6	5·4	do.
2	Y-417-5 ..	1955-56	124·2	3·2	7·0	51·2	4·7	do.	Semi-compact	13·5	6·0	White
		1956-57	130·0	3·5	8·0	47·2	5·6	do.	do.	14·0	6·0	do.
		1957-58	146·6	3·4	8·5	55·6	7·1	do.	do.	10·9	5·2	do.
		1958-59	179·9	3·7	10·4	68·4	6·7	do.	do.	10·8	4·8	do.
		Average	145·2	3·4	8·5	55·6	6·0	do.	do.	12·3	5·5	do.
3	Local ..	1955-56	129·0	4·0	9·0	51·0	5·0	do.	Compact	8·0	4·5	do.
		1956-57	131·0	4·0	9·0	45·8	5·8	do.	do.	8·0	4·3	do.
		1957-58	162·1	4·1	9·2	58·0	6·8	do.	do.	9·8	5·6	do.
		1958-59	199·3	5·2	11·0	67·1	7·6	do.	do.	9·6	4·5	do.
		Average	155·3	4·3	9·5	55·5	6·3	do.	do.	8·8	4·7	do.

Summary and Conclusions

Farm and district trials of *Yenigar* selections from 1955–56 to 1958–59 point out the superiority of G.S. 560–1–1 in grain yield and quality over Y–417–5 and Local *Yenigar*.

Acknowledgements

The author is grateful to Sarwashri S. B. Budhihal and R. B. Patil for help in field observation work during the progress of work.

References

Chavan, Kajjari and Kurtkoti (1955), "Improved *yenigar* jowar, a *rabi* variety for Dharwar District," *Poona Agricultural College Magazine*, **46** (2 and 3), 87–90.

(Received: 30th October 1959)

THE EFFECT OF NITROGEN, PHOSPHORUS AND POTASH APPLICATION ON THE YIELD OF JAYADHAR COTTON*

By S. V. Patil[1] and G. V. Havanagi[2]

Cotton is an important cash crop in India. Mysore State occupies a prominent position in India in respect of cotton cultivation. The State has about 2·3 million acres under cotton, standing only 2nd to Bombay State in respect of area occupied in the Indian Union. Nearly 80% of the total area in Mysore State is concentrated in the black cotton soil region of North Karnatak. Jayadhar is (*G. herbaceum*) an important variety is grwon in this tract. This tract receives an average rainfall of about 20" to 30" distributed over a period from April to November. The soils although have high soil moisture retentive capacity are low in nitrogen and available phosphorus, and as such the average yield of cotton is as low as 150 to 220 lb./acre. With a view to study the response of cotton to nitrogen, phosphorus and potash application, the investigations were carried out at the Agricultural College Farm, Dharwar, and the details are presented in this paper.

Review of Literature

Williams *et al.* (1937) have reported that nitrogen application by inducing early vegetative growth hastens early flowering and potash application prolongs the period of productive fruiting. They have further reported that application P_2O_5 to phosphorus in deficient soils hastens the maturity of cotton. Havanagi and Patil (1956) found that the application phosphorus to irrigated cotton in Deccan canal tract brought early maturity particularly in phosphorus-deficient soils. Tippannavar and Patil (1952) have reported that with the application of 28 lb. nitrogen the yield of Jayawant cotton (*G. herbaceum*) is increased by about 14 per cent.

Material and Methods

An experiment with manuring of nitrogen, phosphorus and potash. to Jayadhar cotton was conducted on the College of Agriculture Farm, Dharwar for two years 1956–57 and 1957–58. The chemical

---

* Paper presented at the 9th Conference on Cotton Growing Problems in India, Dharwar, 1958. Reproduced with permission of the Indian Central Cotton Committee, Bombay.

1, 2 Agronomy Section, College of Agriculture, Dharwar.

and physical analysis of the typical soil type on which the experiment was conducted is given below:

Physical Properties

Loss on ignition%	..	11·18
Sant%	..	13·13
Silt%	..	18·62
Clay%	..	61·00

Chemical Properties

Total Nitrogen %	..	0·063
Total P_2O^5 mgm.%	..	6·56
Total K_2O mgm.%	..	16·70
Ph	..	7·60

During the first year, the doses of each of N P_2O_5 and K_2O were 0·30 and 60 lb./acre and in second year they were 0·15 and 30 lb./acre. applied in one dose at the time of dibbling. The layout was confounded design with 2 replications. The cotton-seeds were dibbled with 2′ × 1′ spacing. The net plot size was 18′ × 30′.

Results and Discussion

Yield.—The average yield of seed cotton for both the years is given in Table I.

The results of the experiments during 1956–57 were not significant. However, the yield figures indicate that application of 30 lb. N and 30 lb. P_2O_5 increase the yields of cotton to extent of 10% over no application of fertilizer. In the second year the results were statistically significant for N and P levels. The yield figures show that there is good resuponse to both the application of nitrogen and Phosphorus. Application of 30 lb. N and 15 lb. P_2O_5 has given higher yields. The increase in yield was to the extent of 50%. Application of potash on the other hand has reduced the yields slightly ; which may be due to high available K_2O in these soils.

Maturity.—The percentage of cotton obtained for the first picking to the total yield (from the experiment 1957–58) is given in Table II.

The figures indicate that nitrogen and phosphorus application singly or in combination hasten maturity. The maturity is considerably hastened when nitroten and phosphorus are applied in combination than when applied singly. The potash application has, however, delayed maturity.

TABLE I

Effect of N, P and K application in yield of seed cotton in lb./acre

Yield	1956–57				1957–58			
	Nitrogen				Nitrogen			
	0	30	60	Average	0	15	30	Average
P_2O_5:								
0	462	411	466	446	0	650	750	804	734
30	436	507	420	454	15	738	804	955	832
60	358	411	335	368	30	695	840	883	806
Average	418	442	406			694	798	880	
K_2O:									Average
0	490	398	367	418	0	707	831	859	799
30	411	478	437	440	15	677	747	883	768
60	352	452	415	407	30	698	816	901	805
Average	418	442	406			694	798	880	
	P_2O_5				P_2O_5			
	0	30	60	Average	0	15	30	Average
K_2O:								
0	495	357	403	418	0	741	862	795	799
30	422	525	380	440	15	747	768	792	768
60	420	480	321	407	30	716	868	831	805
Average	446	454	368			734	832	806	

Not significant

Significant at 1%

C.D. for N and P level .. 46·0

C.D. for table .. 99·0

TABLE II

Percentage of seed cotton obtained in 1st picking

	N in lb./acre			
	0	15	30	Average
P_2O_5 (lb./acre):				
0..	41·3	47·2	48·1	45·5
15..	43·6	50·1	54·5	49·4
30..	44·4	53·7	54·6	50·9
Average ..	43·1	50·3	52·4	
K_2O (lb./acre):				
0..	45·8	51·3	54·8	50·6
15..	42·6	48·1	51·8	47·5
30..	40·9	51·6	50·9	47·5
Average ..	43·1	50·3	52·4	

	P_2O_5 in lb./acre			
	0	15	30	Average
K_2O (lb./acre):				
0..	48·0	48·9	54·9	50·6
15..	42·7	52·0	49·6	47·7
30..	46·2	48·6	48·2	47·5
Average ..	45·5	49·5	50·9	

SUMMARY AND CONCLUSIONS

All experiment with nitrogen, phosphorus and potash application was conducted on the College of Agriculture Farm, Dharwar, during the year 1956–57 and 1957–58. The results indicate that:

(1) Application of 30 lb. N and 15 lb. P_2O_5 to cotton crop increases the yield by about 50%.

(2) Potash application does not increase the yieleds.

(3) Both nitrogen and phosphate application hastens maturity of cotton.

(4) Potash application delays maturity of cotton.

REFERENCES

1. HAVANAGI, G. V. AND PATIL, S. K. (1956), *Indian Sci. Congress 43rd Meeting.*
2. TIPPANNAVAR, M. B. AND PATIL, S. V., *Indian Cotton Growing Review*, **6** (1).
3. WILLIAMS, C. B., BUIE, T. S. AND STACY. S. V. (1937), *North Carolina Agril. Exp. Bull*, 14.

BLAST OF RICE IN MYSORE

Trials with Fungicides for the Control of the Disease

By N. S. Venkatakrishniah[1] and M. H. Delvi[2]

Introduction

Blast on Rice caused by *Piricularia oryzæ* Cav. is a very destructive disease in Mysore. It is observed to be spreading rapidly in the rice growing tracts, particularly with the intensive cultivation of the crop under the Japanese Method of paddy cultivation in the State. Infection is noticed on the seedlings in the nursery, on the leaves at the tillering stage on the neck of the earhead and on the grain. The disease causes considerable damage to the crop. The infected seedlings die in the nursery. The foliar infection on the older plants interferes with photosynthesis. The infection on the neck and grain results in chaffiness and reduces the yield. The loss in yield goes up to 10 per cent. and in severe cases more than 50 per cent. of the crop is lost. The disease assumes an epidemic form in some years and on some varieties of paddy. The virulence of the disease varies according to the climatic conditions prevalent during the crop season and to the susceptibility of the variety to the infection. The loss caused by the disease can be minimized to a very great extent if proper prophylactic measures are taken to protect the crop from infection. Experiments were therefore conducted with some of the new proprietary fungicides at the Agricultural Research Station, Hebbal, Bangalore and at the Paddy Breeding Station, Nagenahalli, Mysore, for four years from 1955–56 to 1958–59. The Results of the same are reported in this paper.

Experimental Details

One per cent. Bordeaux mixture, Sulphur dust (250–300 mesh fine) and Ceresan Lime dust (1 : 5) were used in the spray in all the four years. In addition, some of the new proprietary Copper and Sulphur fungicides were also included in the trials as follows:

Sl. No.	Proprietary fungicides	Strength	Period
1.	Cupravit-ob 21 ..	.. 0·5% solution	1955 to 1957
2.	Perenox ..	.. 0·5% solution	1955 to 1956
3.	Copper Sandoz ..	.. 0·4% solution	1956 to 1957
4.	Ultra sulphur ..	.. 0·3% solution	1957 to 1958
5.	Blitox-50 ..	.. 0·3% solution	1958 to 1959

[1,2] Division of Plant Pathology, Department of Agriculture, Bangalore.

Four varieties of rice, *viz.*, S. 749, Co. 13, H. 294, and S. 705 observed to be easily susceptible to infection were taken up for the experiment. The seeds were disinfected with Agrosan G.N. at the rate of 0·25 per cent. by weight to eliminate seed-borne infections. The plots were heavily dressed with nitrogenous fertilisers to the extent of 80 lb. nitrogen per acre in the form of green manure, compost and ammonium sulphate and late planting was done with a view to create favourable factors conducive to the development of the disease. The disinfected seeds were stored in closed containers for ten days before sowing. They were sown in 25–30 small raised beds of $4\frac{1}{2}' \times 6\frac{1}{2}'$ each so as to have a randomized layout of the treatments. The first application of the fungicides was given on 15 days old seedlings and the second, 10 days later in the nursery. Each treatment was replicated 5 times on a statistical layout both in the nursery and in the field. One gallon pneumatic sprayer with a fine spray nozzle was used for spraying the solutions and the rotary duster for dusting.

The seedlings in the nursery were examined for infection before transplantation in five demarcated places of six inch square each, in each bed. There was not much significant difference in the incidence of infection between the treated and the control beds.

The seedlings from each bed in the nursery were transplanted to the corresponding plots of two cents each in the field following the same statistical design as in the nursery. The plants in each plot were treated a month after transplantation with the same fungicides as in the nursery. The treatment was repeated again 30 days later. 75 to 100 gallons of the mixture and 14 to 15 lb. of the dust were used per acre. The dusting operation was carried out during the early hours in the morning. The crop was examined for incidence of infection at the flowering stage. Five lots of 50 leaves each were collected at random from five rows in each plot. The leaves were sorted out into 4 grades (0–4), *viz.*, (1) healthy, (2) light, (3) medium, and (4) heavy according to the intensity of spotting on the leaves as compared with an illustrated infection grading chart. The incidence of neck rot was noted by collecting 5 lots of samples, each containing 50–100 culms with earheads from 5 places in each plot and sorting them out into healthy and rotten necks.

Results

The following tables give the results of data collected from the experiments. The incidence of infection was negligible on S. 749 during the years 1955–56 and 1956–57 at the Agricultural Research Station, Hebbal, and at the Paddy Breeding Station, Nagenahalli, while it was fairly heavy on S. 705 at Negenahalli and at Hebbal during the season

TABLE I

Percentage neck rot infection

Sl. No.	Treatment	1955–56 Variety (S. 749)		1956–57 Varieties		1957–58 Varieties		1958–59 Varieties	
		Agricultural Research Station Hebbal	Paddy Breeding Station Nagenahalli	(Co. 13) Agricultural Research Station Hebbal	(S. 749) Paddy Breeding Station Nagenahalli	(H. 294) Agricultural Research Station Hebbal	(S. 705) Paddy Breeding Station Nagenahalli	(S. 705) Agricultural Research Station Hebbal	(S. 705) Paddy Breeding Station Nagena halli
1	Control	4·5	7·4	8·4	2·3	10·0	28·0	12·6	14·0
2	Bordeaux mixture	1·4	2·7	1·3	1·0	6·8	20·0	8·8	9·0
3	Ceresan-lime dust	0·8	3·5	2·2	1·0	3·4	17·0	5·0	5·8
4	Sulphur dust	3·3	3·5	3·0	2·0	6·8	22·0	8·6	6·0
5	Cupravit–ob 21	1·4	2·4	2·0	1·5	..	..	..	..
6	Perenox	1·2	..	..	..	..	..	..	..
7	Copper Sandoz.	..	..	2·2	..	..	..	..	..
8	Ultra sulphur	..	..	..	..	3·6	19·0	..	..
9	Blitox–50	..	..	..	..	..	..	6·5	6·5

1957–58. There was heavy infection on Co. 13 at Hebbal in 1956–57. The crop suffered also very badly for want of water in the tank at the milk stage of the earheads and as such the yield was not recorded.

Treatment with Bordeaux mixture gave the most beneficial results. Treatments with Ceresan-lime dust and Copper Sandoz solution also gave comparatively better results during the year 1956–57. Dusting with Ceresan-lime dust had the best effect on the crop, while spraying with Ultra sulphur solution and Bordeaux mixture and dusting with fine sulphur dust were comparatively better than the controls in reducing the neck rot infection in the year 1957–58. In 1958–59 season the treatment with Ceresan-lime dust (1 : 5) had the most beneficial effect on the crop, while sulphur dusting and spraying with Blitox-50 and Bordeaux mixture were comparatively better in controlling the spread of infection.

Parallel experiments with the same fungicides were conducted on a field scale during the periods in private holdings in Bangalore, Mandya, Mysore and Shimoga Districts. The observations made in

TABLE II

Average percentage in the incidence of leaf infection

Sl. No.	Treatments	1956-57	1957-58		1958-59	
		Agricultural Research Station Hebbal	Agricultural Research Station Hebbal	Paddy Breeding Station Nagenahalli	Agricultural Research Station Hebbal	Paddy Breeding Station Nagenahalli
	Varieties	Co. 13	H. 294	S. 705	S. 705	S. 705
1	Control ..	16·6	1·1	9·3	8·6	7·0
2	Bordeaux mixture ..	9·3	0·8	9·3	7·3	3·6
3	Ceresan-lime dust ..	10·0	0·8	9·3	6·6	3·3
4	Sulphur dust ..	10·6	1·3	9·3	7·6	2·0
5	Cupravit-ob 21 ..	12·0	..	..	..	..
6	Copper Sandoz ..	10·0	..	..	..	..
7	Ultra sulphur ..	..	1·0	8·6	..	..
8	Blitox-50 ..	..	..	..	7·3	3·3

TABLE III

Green weight of paddy—yield in lb. per acre

Sl. No.	Treatments	1955-56		1956-57	1957-58		1958-59	
		Agricultural Research Station Hebbal	Paddy Breeding Station Nagenahalli	Paddy Breeding Station Nagenahalli	Agricultural Research Station Hebbal	Paddy Breeding Station Nagenahalli	Agricultural Research Station Hebbal	Paddy Breeding Station Nagenahalli
	Varieties	S. 749	S. 749	S. 749	H. 294	S. 705	S. 705	S. 705
1	Control ..	1358	1068	1090	1624	788	969	936
2	Bordeaux mixture ..	1295	1104	1240	1701	936	1035	1176
3	Ceresan-lime dust ..	1386	1200	1330	1778	1224	1209	1356
4	Sulphur dust ..	1288	1176	1240	1680	912	1067	1260
5	Cupravit-ob 21 ..	1309	1124	1110	..	..	..	..
6	Perenox ..	1358	..	..	..	..	..	..
7	Ultra sulphur ..	..	..	..	1631	885	..	..
8	Blitox-50 ..	..	..	..	..	..	1071	1152

the treated fields conform to the results obtained at the Research Stations at Hebbal and Nagenahalli.

Of the several treatments tried, the mercurial fungicide, *viz.*, Ceresan-lime dust (1 : 5) has given more promising results than the other treatments. Spraying with the Bordeaux mixture, Copper Sandoz, Blitox-50 and Ultra sulphur are also quite effective in controlling the disease and give better results than the untreated crop. The incidence of infection of neck rot can be reduced to more than 50 per cent.

Conclusions

It is thus observed that where seed treatment has been followed systematically by periodical spraying or dusting with a Copper or mercurial or sulphur fungicide in two stages both in the nursery and in the field, the incidence of infection has been very greatly reduced and the yield considerably increased. The results of the experiments carried out so far conform to the results reported on the control of Blast disease of rice by Padmanabhan (1956) and others with regard to beneficial effect of the fungicides on the neck infection and increased yield of crop. Further trials are on hand.

Acknowledgements

Our thanks are due to the Suprintendents and the Agricultural Demonstrators who were in charge of the Agricultural Research Stations, Hebbal and Nagenhally, during the period of the experiments for their interest and help in laying out the experiments.

Reference

Padmanabhan, S. Y., Ganguly, D. and Chandwani, G. G. (1956), "Control of Blast disease of rice with spray fungicides," *Indian Phytopathology*, 9, 15–22.

(Received: 10th December 1959)

General and Review Articles

STEM ROT OR SCLEROTIAL DISEASE ON PADDY CAUSED BY *SCLEROTIUM ORYZÆ*

By H. Krishna Alva*

Introduction

Stem rot, though a minor disease on paddy, is tending to become a serious one. It is observed in many places of South Kanara District causing great damage to the paddy crop. The existence of this disease has been noted as far back as in the year 1913 and it was only since 1948, that the disease has assumed importance in Southern India.

Stem rot disease escapes attention of the cultivator in the early stages. This disease develops mostly in water-logged localities and it is rare in well-drained fields. The disease is characterised by the rotting of the leaf-sheath and the base of the stem. The badly affected plants lodge as the culm colapses.

The fungus causing the disease infects the rice plant at all stages of growth, but is generally noticed only at the later stage of the crop. The plants seem healthy till they reach the boot stage. The organism causing the disease remains in dormant stage in the soil in the form of sclerotia and infection results when the conditions are favourable, that is, when the plants are weakened by adverse factors.

Symptoms

1. The basal portion of the paddy mainly leaf-sheath, lower sheath, and the main stem, show signs of rotting and shredding. Stem of the affected plant, when split open and examined under microscope, show innumerable brown mustard seed-like sclerotia and these are seen embedded in the rotting stem.

2. In some varieries of paddy, green tillers are formed as a result of infection.

3. In most cases the disease is seen in patches but occasionally the entire field may be involved.

4. Generally the disease appears soon after heavy infestation of sucking insects like jassids and fulgorids which lower the resistance of the crop to the disease.

* Plant Protection Assistant, Mangalore.

Association with Insects

In all the affected fields, large number of fulgorids and jassids are noticed, and there appears to reason to believe that the damage caused by the disease is closely associated with the insect attack which renders the plant less able to resist the onset of the disease.

Extent of Damage

The disease is recorded in large area during the first crop season. The second crop is not affected to the same extent. In worst affected fields, the damage to the crop is estimated to be about 90%.

Varieties

The improved strain MTU 3 appears to suffer to a great extent than the local varieties during the first crop season in South Kanara.

Predisposing Causes

The damage was heavy in fields in which the water was allowed to stagnate owing to lack of facilities for draining off. Whenever, the fields are completely drained the damage appears to be slight. The disease could be kept in check by draining off water from the fields frequently.

Manuring in Relation to the Disease

Heavy nitrogenous manuring is reported to be favourable for the development of the disease in Indo-China. It was also recorded that potash is beneficial in arresting the development of the disease.

Remedial Measures

1. Watching the crop during the season for the presence of insects like jassids, fulgorids and treating the same by spraying of DDT 50%—1 lb. in 20–25 gallons of water—for controlling the insect pests and as preventive measure against the appearance of disease.

2. After the disease has set in no remedial measure is possible but, however, draining the fields, drying it for 2 or 3 days and then applying lime at the rate of about 1 cwt. per acre is found to prevent further spread of the disease.

3. In a very late stage of the crop, it is not possible to do anything except to burn the stubbles after harvesting and this would ensure safety to the ensuing crop of paddy.

The following precautionary methods may however be adopted with advantage;

1. The fields should be drained periodically and only just enough water to keep the soil in a wet condition should be let in when the first signs of the disease are noticed.

2. The planting may be done thin to prevent overcrowding.

3. The infected straw should not be carried to uninfested areas.

4. Application of small quantity of ammonium sulphate to give vigour to keep away the disease.

(Received : 2nd December 1959)

CULTIVATION OF 170-Co_2 COTTON UNDER IRRIGATION IN MYSORE STATE

By V. R. Reddy, B.Sc. (Agri.)*

Introduction

Cotton is one of the important money crops in Mysore State with a stipulated area of about 28 lac acres including an area of 50,000 acres under irrigation in Dharwar Divison. The area under irrigation is likely to rise up to an extent of about 2 lacs acres under Tungabhadra and Ghatprabha projects in the near future. The present annual production of cotton of Mysore State is about 5 lacs bales which is to be raised to 7·25 lacs of bales of cotton excluding targeted production of 0·75 lacs of bales of Sea Island cotton at the end of Third Five-Year Plan. There is very limited scope for increasing the production of cotton under rainfed conditions though the area is vast. Instead, there is a great scope for increasing the annual production under irrigated crop.

170–Co_2 cotton is found to be well suited for cultivation under irrigation. This cotton has a staple length of more than 1" with a ginning of 37 per cent. This cotton can spin up to 40s. The per acre yield of 170–Co_2 cotton ordinarily under normal conditions is about 1,000 lb. of seed cotton. With better tillage and adequate doses of fertilizers the per acre yield can be raised to 2,000 lb. or even more. But special care and attention is necessary in respect of control of insects and pests. Due to the heavy foliage and susceptibility the crop is usually infested and subsequently damaged by insects and pests. The crop requires to be treated regularly with pesticides.

Cultivation

(1) *Preparatory tillage.*—As the roots of 170–Co_2 cotton plants go very deep, land is to be ploughed to the extent of 8" to 10" immediately after the previous crop is harvested. The land is to be then prepared by repeated harrowings for sowing.

(2) *Manuring.*—At least 20 cartloads of farm-yard manure is quite essential as a basal dose. 40 lb. of nitrogen in the form of ammonium sulphate or urea and 20 lb. of P_2O_5 in the form of superphosphate, *i.e.*, 200 lb. of ammonium sulphate or 80 lb. of urea with 120 lb. of superphosphate should be given in two doses once at the time of planting and the second dose after about $1\frac{1}{2}$ months. The land should be green manured, preceding to the sowing of 170–Co_2 cotton if possible.

* Cotton Superintendent, Department of Agriculture, Dharwar.

(3) *Sowing.*—The sowing, *i.e.*, dibbling of seed, is to be done during the period from 15th April to 15th May. Early sowing as far as possible is found advantageous.

5 to 6 lb. of seed will be required per acre. Spacing required is 4′ between the rows and 3′ between the plants in a row with 2 good seeds at each hill. Care should be taken to fill up the gaps. Intercropping of maize or groundnut is found remunerative. Intercropping of maize is a common practice under Gokak canal. The intercrop gives a money return of Rs. 200 to Rs. 300 per acre.

(4) *Weeding.*—Clean cultivation is also an important item to be considered in the cultivation of 170–Co_2 cotton. Due to heavy manuring the weeds come up to a great extent. Weeding is to be done repeatedly.

(5) *Protection of crop against insects, pests and diseases.*—The plants of 170–Co_2 cotton grow very tall to a height of about 5′ with great number of branches and with heavy foliage. With certain humidity, the crop is found affected by Black-Arm. More than that, the crop is affected heavily by insects, *viz.*, aphis, jassids, thrips, mealy bugs, leaf rollers, hairy caterpillars, boll worms and also grasshoppers. The insects and pests damage the crop reducing the yield by about 30–40 per cent. The protection of the crop against insects and pests is a more important item in the cultivation of 170–Co_2 cotton. The schedule of the treatment against the disease and insects and pests is given below

(6) *Schedule of control of insecets, pests and diseases:* (*A*) *Control against Black-Arm.*—Seed should be treated with copper or mercury compounds like Perenox or Tillex. One ounce of these compounds is required for treating 10 lb. of seeds, if Perenox is used while one ounce of Tillex will suffice for treating 28 lb. of seeds. This treatment controls the primary infection of Black-Arm. The crop comes up with vigour in the initial stage and develops resistance against the later infections.

(*B*) *Control against insect pests.*—The following schedule gives a common treatment for most of the insects mentioned above:

(*a*) Treatment No. 1	Crop 6 to 8 weeks old	Endrin (Endrex 20% E.C.) 1 oz. in 4 gallons of water *plus* 1/3 oz. of wettable sulphur. 15 to 20 gallons of mixture per acre
(*b*) Treatment No. 2	Crop 10 to 12 weeks old	40 to 50 gallons of the above mixture per acre
(*c*) Treatment No. 3	Crop 14 to 18 weeks old	60 to 80 gallons of the above mixture per acre

Care should be taken to spray the mixture to the undersurface of the leaves also.

(7) *Harvesting.*—Picking of kapas should be done in the morining to avoid mixture of dried leaves and bracts. Harvested kapas should be dried for few hours before it is stored. The stained and insect attacked kapas should be picked separately or removed after picking.

Future Possibilities

The 170–Co_2 cotton is at present grown in Gokak, Athani talukas and Rayabagmahal of Belgaum District and Mudhol, Jamakhandi and Bijapur talukas of Bijapur District on large scale under well irrigation and as well under Ghataprabha canal irrigation. This cotton has covered an area of about 40,000 acres for the present with an annual production of 40,000 bales. This cotton being long-staple cotton with staple length of more than 1″ fetches about Rs. 20 per imperial maund of seed cotton. The present per acre money returns under normal conditions come to about Rs. 1,000 to Rs. 1,200 including the returns of intercrop of maize or groundnut. With better cultural methods and the protection of the crop against pests and diseases, the money returns will automatically increase with the increase of per acre yield of cotton and as well of the better quality.

(Received : 3rd January 1960)

GROUNDNUT SEED-DRILL

By V. M. Mallaraj Urs*

Introduction

Groundnut is one of the important crops of Mysore State. It occupies an area of nearly 2·36 million acres in the State. It grows in tracts receiving a rainfall of 20″ to 35″. This crop is mostly raised under rainfed conditions. Red loamy and black soils are found to be highly suited for raising this crop.

Groundnut as a rainfed crop is raised either dibbling by hand in furrows formed by country ploughs or markers, or by sowing by means of funnels (*sadde*). The drill in usage is of 4 tyned 12″ apart.

Description of the Funnel Type Seed-Drill

The drill used for sowing consists of a head piece, tynes, seed tubes, funnels, beams and handle with grip (Fig. 1). Head piece is made of *Hunse*, *Honne* or *Biligaly* wood, rectangular in section of 3″×4″ or 4″×6″ and varying in length from 3¼′ to 4¼′ according to the type. Holes are made through the head piece at equal distance for fixing tynes. Tynes, made of hollow bamboo pieces of 2½″ diameter, about 8″ to 12″ in length, are fitteed into the holes in the head piece. These tynes are cut obliquely at lower end. The tynes serve the purpose of opening the furrows as well as a passage for the seed to reach the soil. The seed tubes made of hollow bamboo pieces of 2½″ diameter, about 2′ to 2½′ in length, are fitted into the holes in the head piece. The upper end is for receiving the funnel. The funnel is made of thin iron sheets or zinc-sheet of 1½″ diameter at the bottom and 9″ diameter, at the top with a total height of 8″ to 10″. The head piece is provided with a pair of bamboo beams of 8′ length, for bullocks draft, fixed in front of the head piece. A handle is provided at the central top of the head piece of size 1½″×2′×2½′. The drill is provided with a line marker made of iron at either end placed at half the distance between the tynes.

Defects in the Old Types

Dibbling by hand is a most laborious work. Line sowing makes further operations easy. The funnel type seed-drill in usage has cartain disadvantages. Some parts of the drill are made of bamboo pieces.

* Assistant Professor of Mechanical Engineering, College of Agriculture, Hebbal.

The life of tynes and tubes is limited. Four labourers are required to sow the seed which involves extra cost.

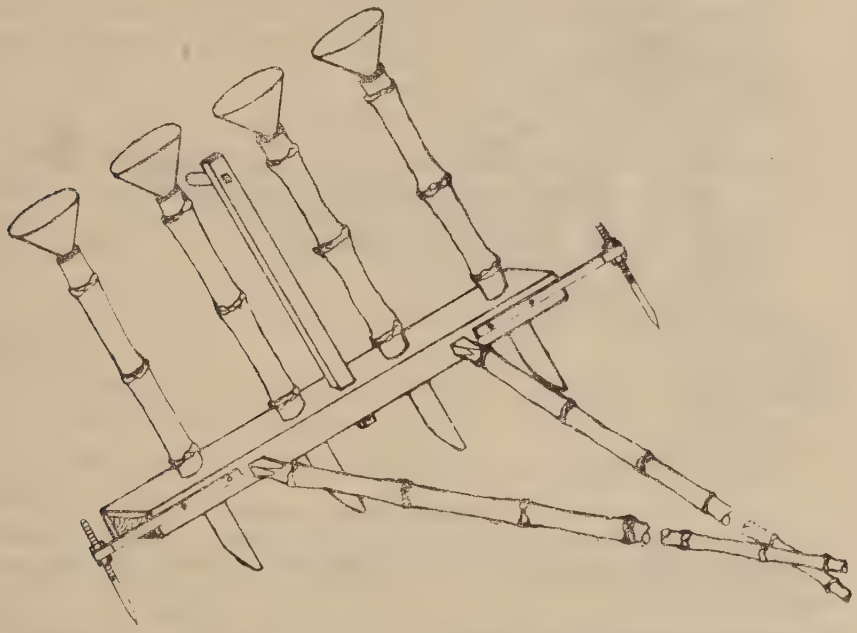


Fig. 1. Funnel Type Groundnut Seed-Drill

The drill is not provided with any seed-covering device. After sowing, the seeds have to be covered by working a brush harrow which involves extra time, labour and cost.

Improvements Effected by the New Seed-Drill

To overcome the drawbacks mentioned above, certain modifications have been devised.

The pattern of the new seed-drill in general resembales the 4-tyne ragi seed-drill, with the following modifications (Fig. 2). The tynes and tubes are replaced by G.I. and Conduit pipes respectively. Four funnels are replaced by a single wooden seed-cup as in the case of ragi seed-drill.

The G.I. tynes make wider furrows and help in easy flow of seeds. The Conduit pipes also facilitate the flow of seeds. The seed-cup helps in easy manipulation. If the covering device is required, a chain can be connected behind the tynes which follow the tynes and cover the seeds in the furrows. This brings about packing of the soil which is necessary for proper seed germination. This device avoids unnecessary duplication of operations, and thus saves time, labour and cost.

By providing a single seed-cup, it helps in completely avoiding three labourers, which saves extra cost.

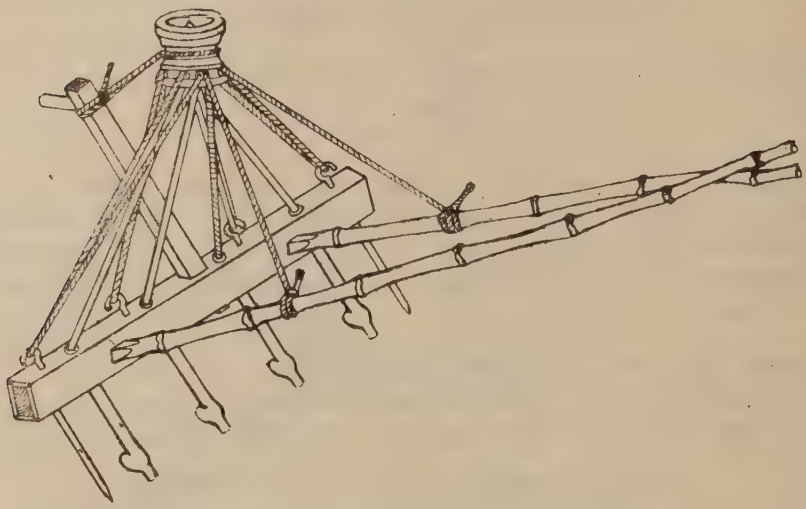


FIG. . Four Tyne Groundnut Seed-Drill

This seed-drill can also be used as fertilizer seed-drill for various crops.

Data collected on the working of the new seed-drill as compared with the funnal type is given below:

Particulars	Funnel type	New seed-drill
1. Weight	30–35 lb.	28¼ lb.
2. Cost of implement	Rs. 15	Rs. 22·25
3. Depth of penetration	2″	2″
4. Labour required for sowing	⅓ pair bullocks and 1⅔ men	⅓ pair bullocks and ⅔ men
5. Cost of working per acre	Rs. 2·66	Rs. 1·66

The labour required for sowing over an area of one acre is ⅓ pair bullocks and 1⅔ men as per the old method, whereas in the new method ⅓ pair bullocks and ⅔ men are required to sow, thus saves 1 man per acre. (It is assumed that one pair of bullocks and 2 men sow an area of 3 acres per day.) If the covering device is provided the time required for working the brush harrow seperately is saved. The cost of the new

drill works out Rs. 22·25 nP. and the funnel type Rs. 15. The cost of working the new drill is Rs. 1·66 per acre, and that of the funnel type is Rs. 2·66. Thus there is a saving of Re. 1·00 per acre in the working expenses. The extra cost of Rs. 7·25 nP. paid towards the new drill is easily recovered after working 8 acres of land, *i.e.*, after working the drill 3 to 4 days.

Conclusions

Sowing groundnut with a 4-tyne seed-drill instead of funnel-type drawn by a pair of bullocks with five men saves on production cost.

The seed-drill covers comparatively larger area of 3 to 4 acres per day.

Line sowing with a seed-drill makes further operations with implements easy.

The distance between the rows is fixed at one foot. The drill is suitable for sowing any type of groundnut.

The sowing and covering operations can be combined into one providing a chain behind.

This drill can also be used as fertilizer drill for various crops.

The life of tynes and tubes will be more. With this device, the time, labour and cost can be reduced.

(Received : 16th January 1960)

NEWS AND NOTES

Ten American Farmers, Mr. Garland and Mr. and Mrs. Estelle Hendricks, from North Carolina, Mr. Ralf and Mrs. Vernera Salisbury of Montana, Mr. Georga and Mrs. Mitchel Neff from Indiana, Mr. Milton and Mrs. Georgia Maxwell from Minnesota, Mr. Rolf Olson from Iowa and Ray W. Allen from Vermont visited us during the second week of January. They were sent to this country by the Association "Farmers and World Affairs" of U.S.A. and their programme in India was sponsored by the Bharat Krishik Samaj. With the kind co-operation of our Friends, the State Farmers' Forum here took upon itself the getting together of experts to talk on Agriculture and rural life in Mysore to the visitors, fixing of host families for their stay and arranging an itinerary to cover places of farming and cultural interest. The presence of the visitors themselves was pleasanter than the routine of the programme.

The U.S.I.S., in arranging for a talk by the visitors, highlighted the "Amrika Mela" section of the World Agricultural Fair". That the arrangement of having got these representatives to serve at the exhibition was both preceded and followed up by their itinerary in the country and contact with agriculturists was a master-idea and among other things it has the effect of taking the World Fair nearer to the minds of the farmers.

The Sixth National Convention of Farmers held during the 2nd week of February 1960 at Delhi attracted a large number of members, expecially as there was the opportunity alongside of it of visiting the World Agricultural Fair. The Farmers' Forum office had quite a busy time in distributing the railway concession forms and informing a large section of the farmers about general outline of the World Agricultural Fair. Nearly three thousand agriculturists from this State have visited the Fair.

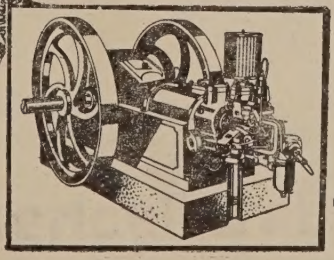
If Farmers' organisations and Co-operatives were amply represented by the elder group of farmers, the 4-H Movement was represented by a selected team also. After the close of the World Fair the Young Americans also took an itinerary round the country and six youngsters visited our State during the first week of March 1960. Mr. Paul Hendrick, Florida, Miss Nancy Nisket, New York, Patricia Stanley Steward, California, Mr. Bud Thar, Michingan, Miss Bottomley, Minneso-a, and Mr. Ken Kehrer, Connecticut, formed the group. They visited our countryside where Young Farmers' Clubs are coming up, as also

other spots of tourist interest round Bangalore and Mysore. State Young Farmers' Association acted as their hosts in the State.

We wish to record the visit of yet two other personages to the Forum, Mr. Clyde M. York, Treasurer, Tennessee Farm Bureau, Columbia, Tennessee and Mr. Wilston Pendgergrass, Dean of Agriculture, University of Tennessee, Knoxville, Tennessee. The Forum is specially thankful to Dr. Long of the Tennessee Team for this and the visit of these authorities is a source of great encouragement to the Forum.

A. S. IYER,
Secretary.

NEVER RAISE A LOAN...



"*Never raise a loan*" is a good dictum handed down from father to son. Yet, every rule has an exception.

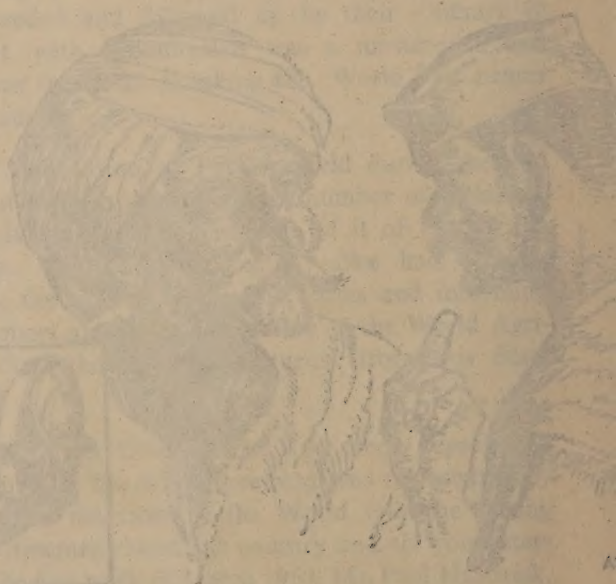
Under the auspices of India's Five-Year Plans, Government has introduced a number of Community Development Projects. Innumerable farmers are today taking advantage of the assistance the Government is rendering, in the shape of Takavi loans, to purchase farm equipment.

Acquiring a Cooper Diesel engine from these loans gives a vital impetus to food production in this country, for, with a Cooper Diesel engine, fields can be well watered and abundant crops raised quickly. The loan can then be repaid in no time. Big crops are the best contribution a farmer can make to the success of the Community Development Projects.

Cooper Diesel Engine — Part and parcel of the Farmer's Life !

WALCHAND COOPER GROUP

COOPER ENGINEERING LTD.
Satara Road, S. Railway



332-60 Printed at The Bangalore Press, Bangalore City, by T. K. Balakrishnan, Superintendent, Edited by Dr. H. R. Arakeri and published by Secretary, Mysore Farmers Forum, Cenotaph Road, Bangalore-2